HORNELLIELLA MACROPORA (SHIPLEY & HORNELL, 1906) COMB. NOV. (CESTODA: TRYPANORHYNCHA) FROM AUSTRALIAN ELASMOBRANCH FISHES AND A RE-ASSESSMENT OF THE FAMILY HORNELLIELLIDAE

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Summary

CAMPBELL, R. A. & BEVERIDGE, I. (1987) *Hornelliella macropora* (Shipley & Hornell, 1906) comb. nov. (Cestoda: Trypanorhyncha) from Australian elasmobranch fishes and a re-assessment of the family Hornelliellidae. *Trans. R. Soc. S. Aust.* 111(4), 195-200, 30 November, 1987.

Hornelliella macropora (Shipley & Hornell, 1906) comb. nov. is redescribed from the elasmobranchs *Stegostoma fasciatum* and *Chiloscyllium punctatum* from northern Queensland. *H. annandalei* (Hornell, 1912) is considered a synonym of *H. macropora*. The armature is described for the first time and consists of a unique poeciloacanthous type in which large, alternating pairs of hollow hooks form a double chainette on the external surface of the tentacle. The presence of an hermaphroditic vesicle is confirmed and illustrations are provided. The family Hornelliellidae Yamaguti, 1954 is considered justified, based on a combination of the unique features of the armature and the genitalia, and is re-defined.

KEY WORDS: Cestoda, Trypanorhyncha, Hornelliellidae, *Hornelliella*, elasmobranchs.

Introduction

Yamaguti (1954) erected the genus *Hornelliella* and the family Hornelliellidae for a single species of trypanorhynch cestode, *Tetrarhynchus annandelei* Hornell, 1912 described from a shark, *Stegostoma fasciatum* (Hermann, 1783) (syn. *S. tigrinum* (Gmelin)), from the Bay of Bengal. The new family was distinguished primarily by the presence of a unique structure within the reproductive system, termed an hermaphroditic vesicle, which was not illustrated, and was supported by several minor characters including the distribution of testes and vitellaria. In trypanorhynchan systematics, the tentacular armature is of prime importance (Dollfus 1942), but neither Hornell (1912) nor Yamaguti (1954) described the armature in sufficient detail to determine the taxonomic position of the family. In addition, Southwell (1929) synonymised *T. annandalie* with *Tentacularia macropora* (Shipley & Hornell, 1906), a fact which Yamaguti (1954) either overlooked or ignored. Cestodes of this family have not been reported previously from the Australian region, however, specimens have recently been collected from *Stegostoma fasciatum* and *Chiloscyllium punctatum* off the coast of Queensland. In this paper the species is described in full for the first time, the taxonomic position of the family Hornelliellidae reassessed, and the family re-defined.

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Materials and Methods

Cestodes from the spiral valves of sharks were fixed in 10% formalin, and were stained with celestine blue, dehydrated in ethanol, cleared in clove oil and mounted in balsam. Tentacles were dissected free and cleared in glycerol. Measurements are given in micrometres, unless otherwise stated, as the range of 10 measurements followed, in parentheses, by the mean.

Terminology for trypanorhynch morphology follows Dollfus (1942). Specimens have been deposited in the Australian Helminth Collection (AHC) of the South Australian Museum, Adelaide. Southwell's specimens of *Tentacularia macropora* were borrowed from the British Museum (Natural History), London (BMNH).

Hornelliella macropora (Shipley & Hornell, 1906) comb. nov.
FIGS 1-11

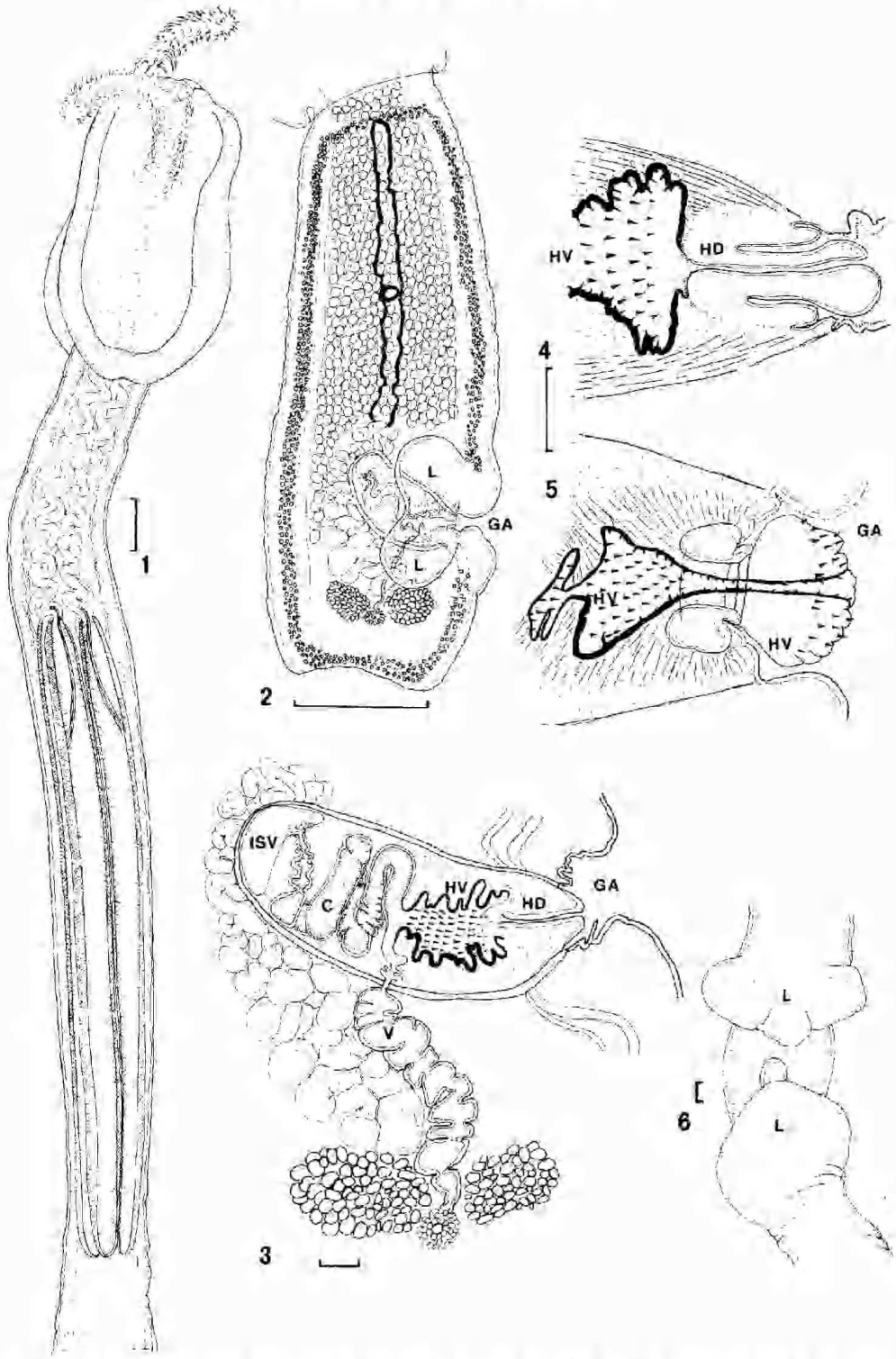
Tetrarhynchus annandalei Hornell, 1912

Hornelliella anandalei (Hornell, 1912) Yamaguti, 1954

Tetrarhynchus macroporus Shipley & Hornell, 1906

Tentacularia macropora (Shipley & Hornell, 1906) Southwell, 1929

Description: Cestodes up to 76 mm long, with up to 63 segments in gravid strobilae. Scolex acraspedote, 7.25–11.2 (8.62) mm long, maximum width at bulbs 0.85–1.02 (0.94) mm. Two bothridia, 1.7–2.6 (2.09) mm by 1.36, 1.38 mm, oval or slightly dumb-bell shaped, notched posteriorly, rim broad, median ridge within each bothridial cavity. Pars



Figs 1–6. *Hornelliella macropora* (Shipley & Hornell) from *Stegostoma fasciatum*. 1, scolex; 2, mature segment; 3, genital system; 4, genital atrium with partial eversion of the hermaphroditic duct; 5, genital atrium with partial eversion of the hermaphroditic vesicle; 6, genital pore, lateral view showing lappets anterior and posterior to pore. Scale lines: Figs 1, 2: 1.0 mm; Figs 3–6: 0.1 mm. Legend: c, cirrus; ga, genital atrium; hd, hermaphroditic duct; hv, hermaphroditic vesicle; isv, internal seminal vesicle; l, lappet; v, vagina.

vaginalis 3.35–5.05 (3.82) mm, sheaths coiled. Bulbs 12 to 15 times longer than wide, 3.57–5.72 (4.74) mm by 0.28–0.38 (0.31) mm in diameter; prebulbar organs absent; retractor muscle attached at anterior end of bulb; pars postbulbosa absent. Scolex not sharply delineated from strobila, merging into neck.

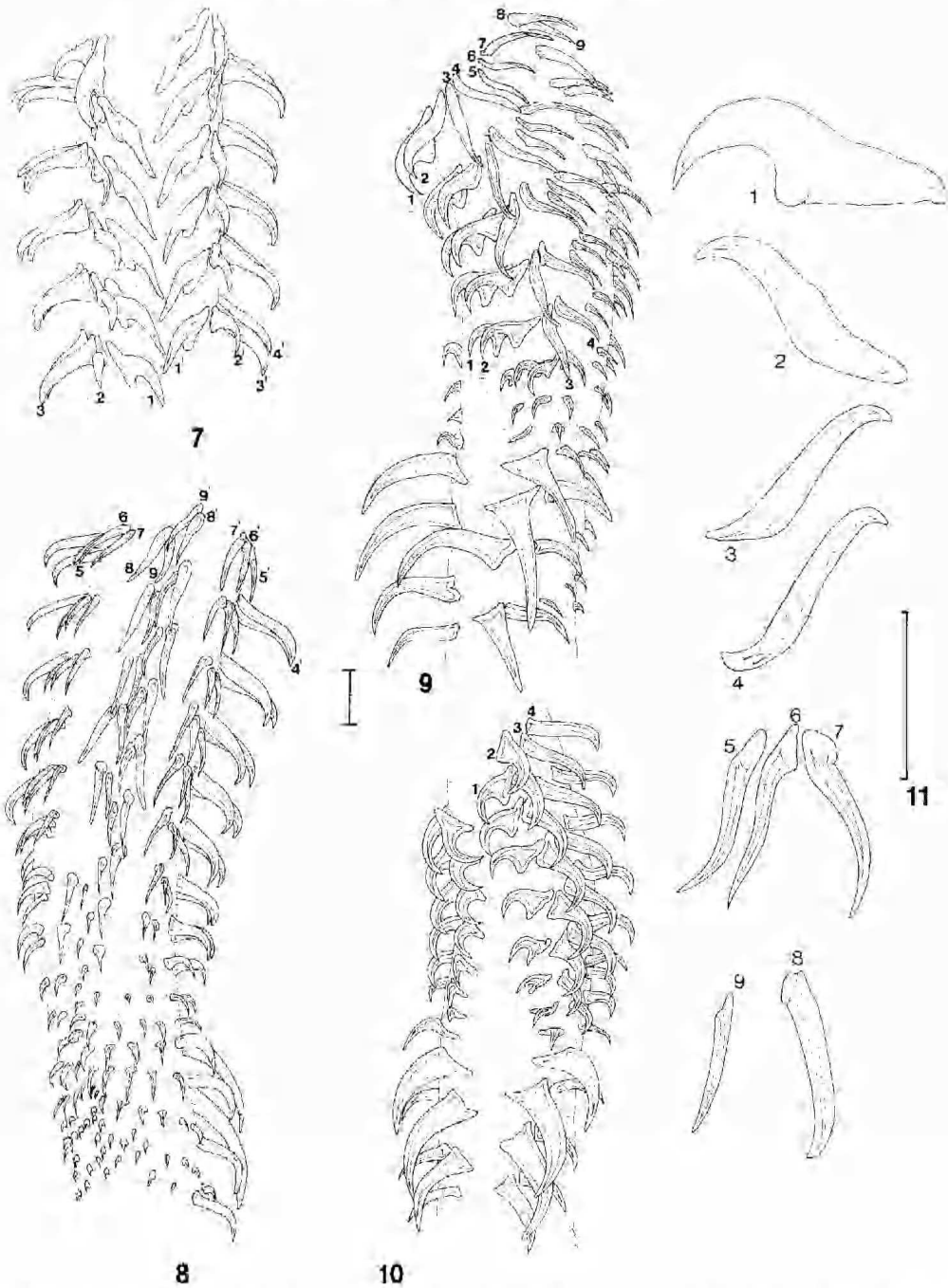
Armature: poecilacanthous, with a chainette of two rows of large, paired hooks on middle of external face in metabasal region; principal rows alternate, forming ascending half spirals beginning on internal face; distinctive basal armature present; no basal swelling; hooks hollow. Tentacle diameter 130–170 (160). Basal armature: about eight ascending half spiral rows of small hooks on each side of external surface; rows alternate. Median, hook-free area present on internal surface of base, tapering toward metabasal region. Hooks 1(1') of proximal four rows of basal armature large, falciform with broad transverse bases; hooks 1(1') of basal rows 2–3 largest, 150–216 (184) long, base 44–90 (62); hooks 2 (2') also large, recurved; remaining hooks small, spiniform, opposing rows meet to form inverted-V formations on external face; spiniform hooks of rows four-six larger than more distal or proximal rows. Basal armature merges gradually into metabasal armature. Metabasal armature: ascending rows with seven hooks per half spiral. Hooks 1(1') widely separated, rose-thorn shaped, length 126–160 (149), base 76–102 (93), smaller near base of tentacle; hooks 2(2') large, falciform, length 110–142 (136), base 50–74 (67); hooks 3(3') slender, falciform, length 130–150 (136), base 32–50 (40); hooks 4(4') slender, falciform, length 110–130 (124), base 20–30 (24). Hooks 5(5')–7(7') spiniform, forming triad, offset at oblique angle and slightly posterior to hooks 4(4'); hooks 5(5'), length 88–100 (93), base 24–32 (26); hooks 6(6'), 82–110 (94) long, base 18–26 (24); hooks 7(7'), 104–120 (112) long, base 18–24 (21). Hooks 8(8') and 9(9') widely separated from hooks 7(7') forming alternate pairs in chainette, each pair opposite a single principal row. Hooks 8(8') and 9(9') spiniform, similar to hooks 5(5')–7(7') of principal rows; hooks 8(8'), 72–112 (99) long, base 20–26 (23); hooks 9(9') smaller, 68–90 (73) long, base 16–28 (22).

Segments appear 1.0–1.5 mm posterior to scolex, initially segments very narrow, becoming elongated, craspedote; mature segments 1.76–2.57 (2.10) mm by 0.89–1.41 (1.18) mm. Testes numerous, 50–60 (50) in diameter, arranged in layers, occupying entire medulla anterior to hermaphroditic sac, traversing dorsal osmoregulatory canals but not ventral pair of osmoregulatory canals; testes absent posterior to hermaphroditic sac. Vas deferens greatly coiled, distended, occupying much of available space between ovary and proximal pole of hermaphroditic sac, penetrating sac from anterior side. Hermaphroditic sac, 520–700 (626) by 250–390 (310), pyriform, thick-walled, proximal pole deviated anteriorly; contains crescentic internal seminal vesicle and coiled cirrus armed with tiny, aciculate spines. Cirrus joins thick-walled, corrugated, hermaphroditic vesicle armed with prominent sagittate spines. Hermaphroditic vesicle joins genital atrium through short, muscular, eversible hermaphroditic canal. Genital pore marginal, irregularly alternate; genital atrium deep, situated in posterior ⅓ of segment, 68–71% of segment length from anterior margin, surrounded anteriorly and posteriorly by two large, fleshy semi-lunar lappets. Ovary tetralobed in cross-section, set forward from posterior margin of segment, lobes subequal, 130–250 (170) by 210–290 (230), Mehlis' gland large, about 280 in diameter, postovarian. Vagina thick-walled, coiled, ascending from Mehlis' gland on poral side of vas deferens to penetrate posterior wall of hermaphroditic sac and join hermaphroditic vesicle. Seminal receptable absent. Uterus simple, median, walls irregularly lobulate, terminating near anterior extremity of segment. Preformed uterine pore almost mid-way between genital pore and anterior margin of segment. Vitellaria follicular, circumcortical, filling postovarian space, surrounding all internal organs except most anterior testes. Eggs ovoid, pale in colour. Longitudinal osmoregulatory canals paired, ventral canals with transverse commissure at posterior margin of segment; dorsal canal medial to ventral canals.

Material examined: 11 specimens from spiral valve of *Stegostoma fasciatum* (Hermann 1783), Balgal, Qld, 14.ix.1985, coll. B. G. Robertson (S2771); 1 specimen from *Chiloscyllium punctatum* Muller & Henle, 1841, Balgal, Qld, 17.ix.1985, coll. B. G. Robertson (S2772).

Discussion

Southwell (1929) synonymised *Tetrarhynchus macroporus* and *T. annandalei* under the combination *Tentacularia macropora*, having examined a range of specimens from different host species, including the type host of *T. annandalei*. Shipley & Hornell's description (1906) of *Tetrarhynchus macroporus* was based on specimens from *Himanturo uarnak* (Forsskål, 1775) (Syn. *Trygon uarnak*). The whereabouts of their specimens is unknown, and no specimens have since been recovered from this host. Their description of the species is brief, and as Southwell (1929) pointed out, differs little from that of *T. annandalei*. Southwell (1929) considered the difference between the two species, namely the presence or absence of a longitudinal



Figs 7–11. Tentacular armature of *Hornelliella macropora* (Shipley & Hornell). 7, internal surface, metabasal region; 8, external surface, basal region; 9, bothridial surface, basal region; 10, internal surface, basal region; 11, profiles of hooks 1(1') to 9(9'). Scale lines: 0.1 mm; figs 7–10 same scale.

division of the bothridium, to be due to intraspecific variation, and noted that contracted specimens are more likely to have a medium sub-division of the bothridia. Southwell's (1929) conclusions are considered justified since if specimens are examined unstained using incident light, there is a prominent, median longitudinal ridge in each bothridium, which becomes virtually invisible when the specimens are cleared. Hornell (1912) also stated that the length of "proboscis hooks" differed between the two species, though no measurements were given in either of the original descriptions. Marked differences occur in hook size and shape on a single tentacle, and hence such comparisons are useless if the position of the hooks being compared is not clearly specified.

Hornell's (1912) specimens of *T. annandalei* were taken from *Stegostoma fasciatum* (Hermann, 1783) (syn. *S. tigrinum* (Gmelin, 1789)), as were those of Yamaguti (1954) and the new specimens described herein. The material examined by Southwell (1929) included specimens from *S. fasciatum* from Sri Lanka (BMNH 1977.11.14.36) as well as specimens from *Galeocerdo cuvier* (Peron & Le Sueur, 1822) (syn. *G. arcticus* (Faber, 1829) and *G. tigrinus* Mueller & Henle, 1839) from Sri Lanka (BMNH 1977.11.14 32–35) and specimens from a host identified on the label simply as *Trygon* sp. (BMNH 1977.11.14.9 and 1977.11.14.21–24) but identified in the text of his paper as *Dasybatus* sp. All specimens clearly belong to a single species, with a wide host range. We therefore support Southwell's (1929) conclusion that *T. macroporus* and *T. annandalei* are conspecific though material from *Himantura uarnak* is needed to confirm this view. Yamaguti (1954) appears to have overlooked this synonymy in his redescription of *T. annandalei*, and hence the correct combination for his new genus becomes *Hornelliella macropora* (Shipley & Hornell, 1906) comb. nov. (syn. *H. annandalei* (Hornell, 1912) Yamaguti, 1954).

Hornelliella palasoorahi Zaidi & Khan, 1976 is the only other nominal member of the genus. The species was said to differ from *H. macropora* only in the size of the cirrus sac (Zaidi & Khan 1976). However, the description is very poor and it is clear from the drawings that it does not belong to the genus *Hornelliella*. Its systematic position cannot be determined and it is considered *incertae sedis*.

The description given herein confirms most of Yamaguti's (1954) observations, except for the single seminal vesicle which appears, from his description, to be external to the cirrus sac, but which in fact, is internal (see Fig. 3).

The armature, described here for the first time, presents several unique features. The large falciform hooks of the basal armature are similar to species of *Gymnorhynchus* Rudolphi, 1819 and *Molicola* (Dollfus, 1935). Also, the external surface of the metabasal armature bears what we have described as a double chainette of hooks which are similar in form to those of the principal rows. The hooks of the chainette are well separated from and opposite to the alternating principal rows as occurs in genera such as *Lacistorhynchus* Pintner, 1913 and *Callitetrarhynchus* Pintner, 1931. All of the hooks are hollow and are not accompanied by satellite hooks or by intercalating rows of hooks. Although a poeciloacanthous type of hook arrangement fitting the orderly arrangement found in a chainette, it could also be interpreted as a "band" of hooks such as is found on the external surface of the tentacles of species *Molicola* and *Grillotia* (see Dollfus 1942). However, such bands of hooks in poeciloacanth trypanorhynchs frequently show little or no orderly linear arrangement of their elements and the hooks may vary both in size and in form. We therefore prefer to consider the hook arrangement seen in *Hornelliella* as a modified chainette.

A double chainette with hooks in a tandem position, occurs in *Lacistorhynchus* and *Eulacistorhynchus* Subhapradha, 1957 (Lacistorhynchidae), in *Callitetrarhynchus* (Dasyrhynchidae), *Gymnorhynchus* (Gymnorhynchidae) and some species of *Dasyrhynchus* Pintner, 1928 (Dasyrhynchidae). Simple chainettes with hooks in a single row occur in *Floriceps* Cuvier, 1817 (Dasyrhynchidae), *Halysiorhynchus* Pintner, 1913 (Pterobothriidae), *Mixodigma* Dailey & Vogelbein, 1982 (Mixodigmatidae) and in some species of *Dasyrhynchus*. No genus described to date has a chainette composed of pairs of hooks in tandem, and the structure seen in *Hornelliella* is unique among the Trypanorhyncha.

Yamaguti (1954) erected a new family and genus for the species based primarily on the presence of a unique, hermaphroditic vesicle, which he did not illustrate. Yamaguti's description is correct, and both cirrus and vagina join a large, thick-walled vesicle armed with sagittate spines. The vesicle leads, via a highly muscular hermaphroditic duct, to the genital atrium. A fully everted cirrus was not observed but the hermaphroditic duct appears to be eversible and the vesicle is capable of being partially protruded through the duct, with the characteristic sagittate spines being visible on the external surface (Fig. 5). Although the vesicle appears to be unique, a union of male and female ducts within the "cirrus sac" (=hermaphroditic pouch of Yamaguti (1954)) occurs in *Lacistorhynchus* (see Dollfus 1942) but in the latter case there is no armed vesicle, merely a simple hermaphroditic duct referred to as the "genital atrium" by Dollfus (1942) because the "atrium" is

everted first, followed by the cirrus. A similar mechanism of evagination may operate in *H. macropora*. We consider the terminology used by Yamaguti (1954) of hermaphroditic duct and hermaphroditic vesicle preferable to that used by Dollfus (1942) for *Lacistorhynchus tenuis*.

Yamaguti (1954) erected the family Hornelliellidae based on the presence of an hermaphroditic vesicle, testes anterior to the "cirrus sac", presence of paired lappets around the genital atrium, a series of muscular rings in the tentacle sheaths and circumcortical vitelline follicles which formed a band posterior to the ovary. Of these characters, the muscular rings of the tentacle sheaths were not visible in our specimens, and we doubt whether such precise distribution of the testes and vitellaria will prove to be family characters. However, the armature is unique in that each pair of hooks in the chainette is contributed by a single, principal row, in alternating fashion. Furthermore, the hooks of the chainette are similar in shape to those of the principal rows instead of being markedly different.

On the basis of its armature and the hermaphroditic vesicle we consider that the Hornelliellidae is valid and that it is most closely related to the pocciloacanthous families Lacistorhynchidae Guiart, 1927 and Gymnorhynchidae Dollfus, 1935. A redefinition is given below.

Hornelliellidae Yamaguti, 1954. *Hornelliella* Yamaguti, 1954. Scolex elongate, acraspedote; two oval bothridia each with median longitudinal ridge. Metabasal armature poeciloacanthous, chainette of two rows of large paired hooks; intercalary hooks absent; distinctive basal armature present; no basal swelling. Tentacle sheaths coiled; prebulbar organ absent; retractor muscle originates in anterior third of bulb. Pars postbulbosa absent. Genital pores marginal, irregularly alternate. Testes numerous, scattered, anterior to genital pore; internal seminal vesicle present; male and female ducts unite to form armed hermaphroditic vesicle; genital pore surrounded by lappets. Vitellaria follicular, circumcortical, pre and post-ovarian. Uterus simple, median, tubular; preformed uterine pore present. Parasites of sharks and rays.

Acknowledgments

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